Metal Cutting Tools

MANUFACTURE, USE AND CARE

A Reference Book
and
Tool Catalog
for the
Repair Garage Mechanic

PREPARED BY

KEYSTONE REAMER & TOOL CO.
MILLERSBURG, PA.
U. S. A.

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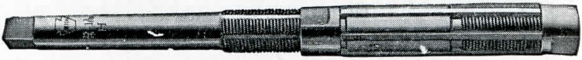
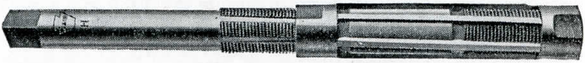
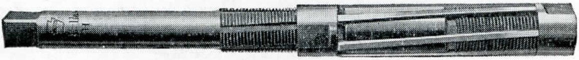
Keystone Six Adjustable Reamer



No. 114—Straight Blades



No. 114A—Angle Blades



No. 114S—Spiral Blades

A high-grade Adjustable Reamer, having six carbon alloy steel blades set staggered in the body. It is made with either straight, angle, or spiral blades.

The range of adjustment is 1/64-inch more than tables indicate.

No.	Size Inches	Expansion Inches	Straight Blades	Angle Blades	Spiral Blades
W	¼	8/32 to 9/32	$4.05		
X	9/32	9/32 to 10/32	4.05		
Y	5/16	10/32 to 11/32	4.05		
Z	⅜	11/32 to 13/32	4.05		
Aa	7/16	13/32 to 15/32	4.05		
A	½	15/32 to 17/32	4.05	$4.05	$4.95
B	9/16	17/32 to 19/32	4.05	4.05	5.20
C	⅝	19/32 to 21/32	4.30	4.30	5.40
D	11/16	21/32 to 23/32	4.30	4.30	5.65
E	¾	23/32 to 25/32	4.50	4.50	5.85
F	13/16	25/32 to 27/32	4.50	4.50	6.10
G	⅞	27/32 to 15/16	4.95	4.95	6.30
H	1	15/16 to 1 1/16	5.25	5.25	6.55
I	1⅛	1 1/16 to 1 3/16	6.30	6.30	
J	1¼	1 3/16 to 1 11/32	7.20	7.20	
K	1½	1 11/32 to 1 17/32	9.00	9.00	
L	1¾	1 17/32 to 1 25/32	10.35		
M	2	1 25/32 to 2 3/32	13.50		
N	2¼	2 3/32 to 2 15/32	16.20		
O	2½	2 15/32 to 2 31/32	19.80		
P	3	2 31/32 to 3 ½	23.40		
Q	3¾	3 ½ to 4 1/16	27.00		

Keystone Adjustable Reamer Sets

In Hardwood Cases

NO. 1 SET
Keystone Adjustable Reamers
Eight Reamers
Ranging from ½ to 1 1/16 inches
Keystone Reamer & Tool Co.
Millersburg, Pa.

Adjustable Reamer Set No. 1C

CONTAINS EIGHT REAMERS

A 15/32 to 17/32
B 17/32 to 19/32
C 19/32 to 21/32
D 21/32 to 23/32
E 23/32 to 25/32
F 25/32 to 27/32
G 27/32 to 15/16
H 15/16 to 1 1/16

Straight or Angle Blades. Price $35.85
Spiral Blades. Price $45.90

Adjustable Six Set No. 2C

CONTAINS ELEVEN REAMERS

A 15/32 to 17/32
B 17/32 to 19/32
C 19/32 to 21/32
D 21/32 to 23/32
E 23/32 to 25/32
F 25/32 to 27/32
G 27/32 to 15/16
H 15/16 to 1 1/16
I 1 1/16 to 1 3/16
J 1 3/16 to 1 11/32
K 1 11/32 to 1 17/32

Straight or Angle Blades. Price $58.35

Keystone Standardized Pilot Piston Pin Expansion Reamers

SPIRAL FLUTES

No. 1106

Decimal Size	Fractional Size	Length	Price
.625	⅝	10¼	$8.00
.656	21/32	10¼	8.40
.667		10¼	8.80
.687	11/16	10¼	8.80
.730		10½	9.60
.734	47/64	10½	9.60
**.738		10½	9.60
*.740		10½	9.60
**.750	¾	10⅞	9.60
**.796		11⅜	10.50
**.812	13/16	11⅜	10.50
.843	27/32	11⅜	11.00
**.850		11⅜	11.50
*.856		11⅜	11.50
*.859	55/64	11⅜	11.50
*.865		11⅜	11.50
**.875	⅞	12¼	11.50
*.917		12¼	12.50
.927		12¼	12.50
*.937	15/16	12¼	12.50
*.968	31/32	12¼	13.00
*984	63/64	12¼	13.50
**.990		13⅝	13.50
*1.000	1	13⅝	13.50
1.047	1 3/64	13⅝	14.50
*1.062	1 1/16	13⅝	14.50
*1.093	1 3/32	13⅝	15.00
1.106		13⅝	15.50
1.109	1 7/64	13⅝	15.50
*1.125	1⅛	13⅞	15.50
1.156	1 5/32	13⅞	16.00
1.187	1 3/16	13⅞	16.60
1.218	1 7/32	13⅞	17.20
1.225		13⅞	17.50
1.231		13⅞	17.80
1.235	1 15/64	13⅞	17.80
1.250	1¼	14⅞	17.80
1.294		14⅞	19.00
1.300		14⅞	19.00
1.312	1 5/16	14⅞	19.00
1.375	1⅜	14⅞	21.00
1.437	1 7/16	15¾	23.00
1.500	1½	16½	25.00

The sizes marked * and ** are the important ones. Those marked ** are the most used.

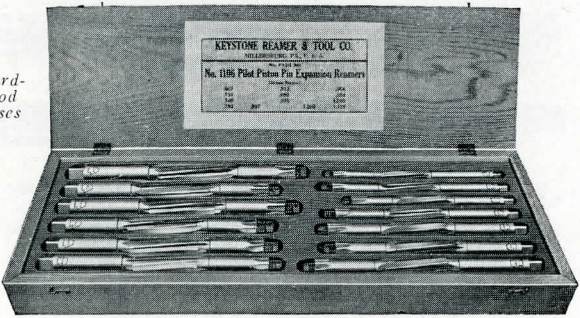
These * and ** sizes can be furnished in .010 oversize at same price.

These Reamers are also made in larger sizes up to 2⅛ ins.

"KEYSTONE TOOLS DO THE JOB RIGHT"

Pilot Piston Pin Expansion Reamer Sets
Keystone Standardized No. 1106

In Hard-wood Cases


KEYSTONE REAMER & TOOL CO.
No. 1106 Pilot Piston Pin Expansion Reamers

Set No. P-123 (Six Reamers)

SIZES: .738 .750 .796 .812 .850 .875

In Hardwood Case. Price $63.20

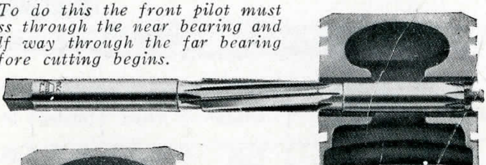
Set No. P-124 (Twelve Reamers)

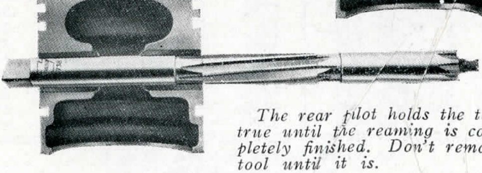
SIZES: .738 .750 .796 .812 .850 .875
.937 .990 1.000 1.062 1.093 1.125

In Hardwood Case. Price $147.50

TO ACCURATELY align piston-pin bearings, use a properly designed pilot piston pin reamer and ream both bearings in one operation.

To do this the front pilot must pass through the near bearing and half way through the far bearing before cutting begins.

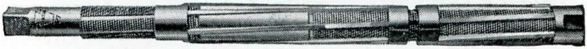




The rear pilot holds the tool true until the reaming is completely finished. Don't remove tool until it is.

Keystone-Six Adjustable Pilot Piston Pin Reamers

No. 1107—Straight Blades



No. 1107S—Spiral Blades

No.	Fractional Sizes Inches	Decimal Sizes	Length Over All Inches	Price	
				Straight Blades	Spiral Blades
P1	5/8 to 11/16	.625– .687	9 7/8	$9.00	$10.50
P2	11/16 to 3/4	.687– .750	10 1/8	9.25	10.75
P3	3/4 to 13/16	.750– .812	10 13/16	9.50	11.00
P4	13/16 to 7/8	.812– .875	11	10.00	12.00
P5	7/8 to 15/16	.875– .937	12 5/16	10.50	12.50
P6	15/16 to 1	.937–1.000	12 5/8	11.00	13.00
P7	1 to 1 1/16	1.000–1.062	13 3/4	12.00	14.50
P8	1 1/16 to 1 1/8	1.062–1.125	13 7/8	13.00	15.50

No. 1107 Reamer Set—No. 1 to No. 8
Eight Reamers—$84.25

Keystone Adjustable Blade Pilot Reamer with Floating Pilot

No. 114FP

Size	Expansion Decimals	Length	Price	Blades	Nuts
C	.593– .656	11 3/8	$9.00	$0.30	$0.30
D	.656– .718	11 5/8	9.25	.30	.30
E	.718– .781	12	9.50	.35	.35
F	.781– 843	12 1/4	10.00	.35	.35
G	.843– .937	12 5/8	10.50	.40	.40
H	.937–1.062	12 15/16	12.00	.40	.40
I	1.062–1.187	13 1/16	14.50	.45	.45
J	1.187–1.343	13 5/16	16.50	.45	.45
K	1.343–1.531	13 3/4	18.50	.55	.55

No. 114FP Reamer Set—No. D to I
Six Reamers—$65.00

"KEYSTONE TOOLS DO THE JOB RIGHT"

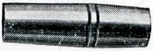
Keystone Standardized Pilot Piston Pin Reamers, No. 1111

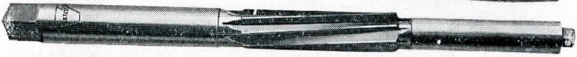
Decimal Size	Price	Decimal Price	Size
.625	$8.00	.859	$11.50
.656	8.40	.865	11.50
.667	8.80	*.875	11.50
.687	8.80	.917	12.50
.730	9.60	.927	12.50
.734	9.60	*.937	12.50
*.738	9.60	*.968	13.00
.740	9.60	*.984	13.50
*.750	9.60	*.990	13.50
*.796	10.50	*1.000	13.50
*.812	10.50	1.047	14.50
.843	11.00	*1.062	14.50
*.850	11.50	*1.093	15.00
.856	11.50	*1.125	15.50

No. 1111 Reamer Set—$63.20
Six Reamers—.738 .750 .796 .812 .850 .875

Keystone Standardized Piston Pin Reamer with Floating Pilot

No. 1105





Decimal Size	Price	Decimal Size	Price
.625	$9.00	.859	$13.00
.668	10.00	.865	13.00
.687	10.00	*.875	13.00
.730	11.00	.917	14.00
*.734	11.00	*.937	14.00
*.738	11.00	*.968	14.50
*.740	11.00	*.984	15.00
*.750	11.00	*.990	15.00
*.796	12.00	*1.000	15.00
*.812	12.00	1.047	16.00
.843	12.50	*1.062	16.00
.850	13.00	*1.093	17.00
.856	13.00	*1.125	17.50

No. 1105—Reamer Set—$72.00
Six Reamers—.738 .750 .796 .812 .850 .875

Standardized Valve Guide Reamers

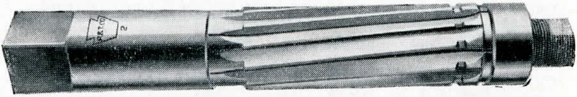
Long Solid Pilot Reamer—No. 1100

Long Expansion Pilot Reamer—No. 1101

For Reaming Valve Stem Guide Bearings

Fractional Size	Decimal Size	Length	Solid No. 1100	Expansion No. 1101
19/64	.296	7	$1.80	$3.70
5/16	.312	7	1.80	3.70
**21/64	.328	7	1.85	3.75
11/32	.343	8	1.85	3.75
*23/64	.359	8	1.90	3.75
3/8	.375	8	1.90	3.80
**25/64	.390	8	2.00	3.85
13/32	.406	8	2.05	3.90
*27/64	.421	8	2.05	3.90
7/16	.437	8	2.05	3.90
**29/64	.453	8	2.15	3.95
*31/64	.484	8¾	2.20	4.00
½	.500	8¾	2.20	4.00
*33/64	.515	8¾	2.25	4.05
9/16	.562	8¾	2.40	4.35
37/64	.578	8¾	2.40	4.35
39/64	.609	9	2.50	4.50

Standardized Connecting Rod Reamers

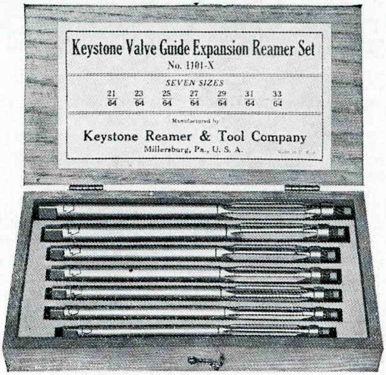


For Reaming Large End Connecting Rod Bearings

Size	Price	Size	Price	Size	Price
**1¼	$10.70	1 55/64	$18.60	2 3/16	$21.60
1⅜	12.60	**1⅞	18.70	2 15/64	22.20
**1½	15.00	1 63/64	19.80	*2¼	22.30
**1⅝	16.20	**2	19.90	2 5/16	22.80
1 11/16	16.80	2 3/32	21.00	*2⅜	23.40
1¾	17.40	2 7/64	21.10	2½	24.60
1 13/16	18.00	*2⅛	21.20		

Keystone Standardized Valve Guide Expansion Reamer Set No. 236

In Hardwood Cases.
Size 1¾x5¼x 10 in.
Weight 3¾ lbs.


Keystone Valve Guide Expansion Reamer Set
No. 1101-X
SEVEN SIZES
21/64 23/64 25/64 27/64 29/64 31/64 33/64
Manufactured by
Keystone Reamer & Tool Company
Millersburg, Pa., U. S. A.

CONTAINS SEVEN EXPANSION REAMERS

5/16	$3.70	11/32	$3.75	3/8	$3.80
21/64	3.75	23/64	3.75	25/64	3.85
		7/16	$3.90		

Set Complete, Price $26.50

Keystone Standardized Expansion King Bolt Reamers

Size	Length	Price Straight Flutes	Price Spiral Flutes
½	10 15/16	$7.00	$8.40
9/16	11 5/16	7.50	9.00
5/8	13 7/8	8.00	9.60
11/16	14 7/8	9.00	10.80
¾	15 1/16	10.50	12.60
13/16	15 7/16	11.50	13.80
7/8	15 13/16	12.50	15.00
15/16	15 13/16	13.50	16.20
1	16 3/8	14.50	17.40

Keystone Special Reamers

FORD MODEL T	Spiral Solid	Spiral Expansion
617-1 Valve Seat Reamer	$2.05	....
2713-14 Spindle Body and Arm	2.45	....
3022½ Piston Pin	2.45	$9.60
3052B Valve Stem 1⁄64 O. S.	2.20	4.50
3974 Fan-Driven Pulley (New)	2.45	8.00

OLD STYLE	Straight Flutes	Spiral Flutes
2713-14 Spindle Body and Arm	$1.35	$1.40
3022½ Piston Pin	1.90	2.10
3052B Valve Stem	1.70	1.90

FORD MODEL A	Solid Spiral Flutes	Expansion Spiral Flutes
Piston Pin—Special Pilot	$4.95	$13.50
Piston Pin	4.45	8.10
King Bolt—Special Pilot	4.95	13.80
Water Pump—Special Pilot	3.40	8.65
Steering Sector	4.30	9.30
Steering Sector Pilot	9 00	15.50
Valve Seat Tool	3.00	.....
King Bolt, with Pilot, Model AA Truck	6.65	17.40

FOR CHEVROLET	Solid Spiral	Expansion Spiral
King Bolt for 1924-27	$4.50	....
King Bolt 1924-27 with Pilot	6.50	$9.00
Water Pump Reamer. All Models	3.00	4.80
Steering Gear Arm Shaft, National	4.50	8.50
Steering Gear Arm Shaft, National, with Pilot	8.00	16.50
Steering Gear Main Shaft, National	4.00	7.50
King Bolt, National	5.00	....
King Bolt, National, with Pilot	7.50	12.00
Valve Seat, National	2.25	....
Buick Rocker Arm	$5.00	$9.00
Buick Water Pump	6.00	7.50
Dodge Water Pump		8.00
Hudson Water Pump		10.50
Hudson King Bolt, Special		13.80
White Water Pump	3.20	

Keystone Service Sets

Keystone Auto Service Sets
For Garages and Service Stations
Manufactured by
KEYSTONE REAMER & TOOL CO.
Millersburg, Pa.
U.S.A.

For Fords and Chevrolets

FORD—For Model A Cars

1. Piston Pin Reamer
2. King Bolt Reamer
3. Connecting Rod Reamer
4. Water Pump and Fan Reamer
5. Valve Reseating Tool

Five Reamers in Hardwood Case
Solid, $21.00; Expansion, $53.00

CHEVROLET SETS—For Six-Cylinder Models

1. No. 1106 Piston Pin .990
1. No. 1101 Valve Stem 5⁄16″
1. No. 5006 Rocker Arm
1. No. 5005P King Bolt
1. No. 4096 Water Pump

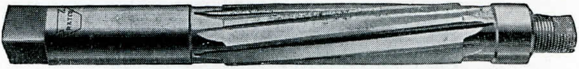
Five Reamers in Hardwood Case
Expansion—Price, $31.00

Keystone Taper-Pin Reamers

No. 172

Size	Each	Diameter Small End Inch	Length Over All Inches	Length Flute Inches
0	$0.80	.127	2⅜	1⅝
1	.80	.146	2½	1¾
2	1.00	.162	3	2
3	1.20	.183	3½	2¼
4	1.40	.208	4	2½
5	1.60	.240	4½	3
6	1.80	.279	5	3⅝
7	2.00	.331	6	4½
8	2.40	.398	6¾	5¼
9	2.80	.482	8	6⅛

Keystone Expansion Reamers



No. 100S. Spiral Fluted Reamer

Diameter Inches	Straight Flutes No. 100	Spiral Flutes No. 100S	Length Over All Inches
¼	$3.00	$3.60	3⅞
9/32	3.05	3.70	4
5/16	3.10	3.75	4
11/32	3.15	3.80	4¼
⅜	3.20	3.85	4¼
13/32	3.25	3.90	4½
7/16	3.30	4.00	4½
15/32	3.35	4.05	5
½	3.40	4.10	5
17/32	3.50	4.20	5½
9/16	3.65	4.40	5½
19/32	3.80	4.60	6
⅝	4.00	4.80	6
21/32	4.20	5.05	6¼
11/16	4.40	5.30	6¼
23/32	4.60	5.55	6 9/16
¾	4.80	5.80	6 9/16
25/32	5.00	6.00	7 1/16
13/16	5.25	6.30	7 1/16
27/32	5.50	6.60	7½
⅞	5.75	6.90	7½
29/32	6.00	7.20	7⅞
15/16	6.25	7.50	7⅞
31/32	6.50	7.80	8⅜
1	6.75	8.10	8⅜
1 1/32	7.00	8.40	8 11/16
1 1/16	7.25	8.70	8 11/16
1 3/32	7.50	9.00	9
1⅛	7.75	9.30	9
1 5/32	8.00	9.60	9⅜
1 3/16	8.30	10.00	9⅜
1 7/32	8.60	10.35	9¾
1¼	8.90	10.70	9¾
1 9/32	9.20	11.05	10⅛
1 5/16	9.50	11.40	10⅛
1 11/32	10.00	12.00	10½
1⅜	10.50	12.60	10½
1 13/32	11.00	13.20	10⅞
1 7/16	11.50	13.80	10⅞
1 15/32	12.00	14.40	11⅛
1½	12 50	15.00	11⅛
1 9/16	13.00	15.60	11¼
1⅝	13.50	16.20	11½
1 11/16	14.00	16.80	11⅝
1¾	14.50	17.40	11⅞
1⅞	15.50	18.60	12¼
2	16.50	19.80	12 9/16
2¼	18.50	22.20	13
2½	20.50	24.60	14

"KEYSTONE TOOLS DO THE JOB RIGHT"

Keystone Expansion Reamer Set

No. 10 SET

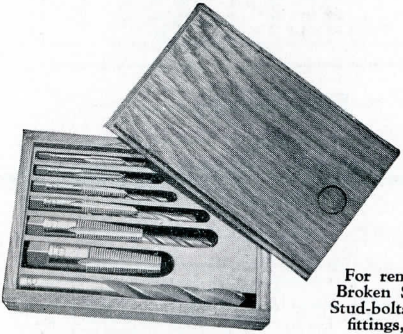
**CONTAINS
10 STANDARD
EXPANSION
REAMERS**

7/16 1/2 9/16 5/8
11/16 3/4 13/16 7/8
15/16 1 inch

PRICE
Straight
$48.00
Spiral $58.00

Keystone Screw Remover Set

No. 225



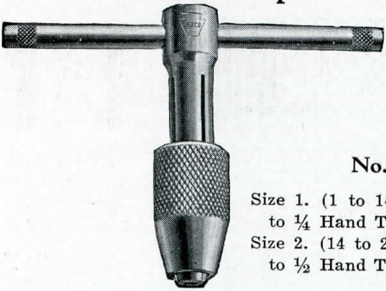
**For removing
Broken Screws,
Stud-bolts, Pipe-
fittings, etc.**

Patent Applied For

SIX REMOVERS SIX DRILLS

Set Complete, Drills and Removers for sizes 1/8 to 1 in.
Price $5

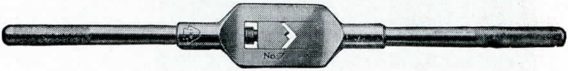
T-Handle Tap Wrenches



No. 526

Size 1. (1 to 14 M. S. Taps. ⅛ to ¼ Hand Taps). Price $0.50.
Size 2. (14 to 20 M. S. Taps. ¼ to ½ Hand Taps). Price $1.00.

Tap and Reamer Wrenches



No. 525

Size	Price Each	Sizes of Tap Wrench Holds Inches	Sizes of Reamer Wrench Holds Inches	Length Over All Inches
1	$3.60	1/16 to ¼	⅛ to ¼	7
2	4.20	¼ to ½	¼ to ½	11
3	4.80	¼ to ¾	½ to ⅞	16
4	6.00	½ to 1	⅞ to 1¼	21

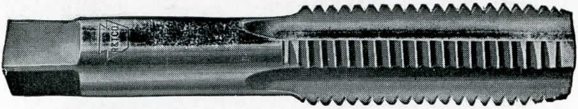
Die Stocks

No. 650

For Round Dies and Two-Piece Die Collets

Size	Outside Diam. Dies Inches	Length Stock Inches	Price Each	Size	Outside Diam. Dies Inches	Length Stock Inches	Price Each
1	13/16	7	$1.40	4	2	23	$3.45
2	1	10	1.70	5	2½	26	4.80
3	1½	14	2.75	6	2¾	26	6.15

Thread Cutting Taps and Dies



Size	Hand Taps		No.	Machine Screw Taps	
	Thread	Price Each		Thread	Price Ea.
¼	20 or 28	$0.45	2	56	$0.30
5⁄16	18 – 24	.50	3	48	.30
⅜	16 – 24	.55	4	36	.30
7⁄16	14 – 20	.60	5	36	.25
½	13 – 20	.75	6	32	.25
9⁄16	12 – 18	.85	8	32	.25
⅝	11 – 18	.95	10	32	.30
¾	10 – 16	1.40	10	24	.30
⅞	9–14–18	1.85	12	24	.30
1	8 – 14	2.30	14	20	.45
1⅛	6 – 12	3.10	14	24	.45
1¼	7 – 12	3.55	16	20	.45
1⅜	7 – 12	4.10	18	18	.50
1½	6 – 12	4.80	20	16	.50

PIPE TAPS

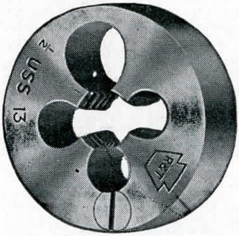
⅛	$0.60
¼	.70
⅜	.95
½	1.15

STOVE BOLT TAPS

3⁄16—24	$0.30
¼—18	.45
5⁄16—18	.50
⅜—16	.55

SPARK PLUG TAPS

½ inch	$1.15
⅞ inch	$1.85
18 m/m	$1.20



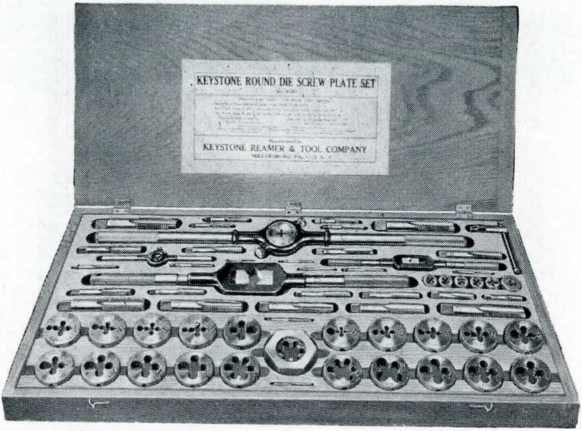
Round Dies

In All the Above Tap Threads

Outside Diam.	In All Cutting Sizes From	Price
13⁄16	2 to 20	$1.05
1	¼ to ½	1.05
1½	¼ to ½	1.70
2	¼ to 1	2.75

"KEYSTONE TOOLS DO THE JOB RIGHT"

Special Garage Screw Plates


KEYSTONE ROUND DIE SCREW PLATE SET
KEYSTONE REAMER & TOOL COMPANY

Combination U. S. S., S. A. E. and M. S. S. Sizes

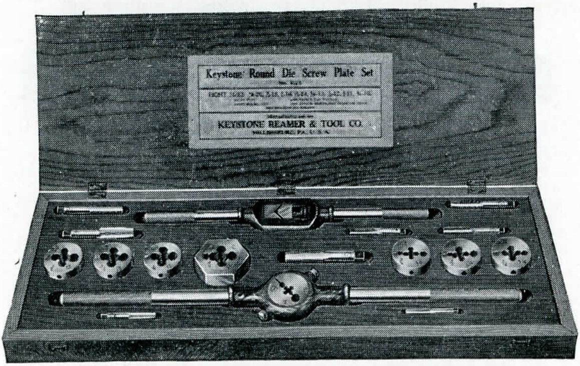
*No. R30. Twenty-nine Sizes: 4-36, 6-32, 8-32, 10-24, 10-32, 12-24, 14-20 M. S. S. ¼-20, ⁵⁄₁₆-18, ⅜-16, ⁷⁄₁₆-14, ½-13, ⁹⁄₁₆-12, ⅝-11, ¾-10, ⅞-9, 1-8 U. S. S. ¼-28, ⁵⁄₁₆-24, ⅜-24, ⁷⁄₁₆-20, ½-20, ⁹⁄₁₆-18, ⅝-18, ¾-16, ⅞-14, 1-14 S. A. E. ⅛, ¼ Pipe Sizes. All above both Taps and Dies.
⅞-18 Spark Plug Tap only........................$74.75

This No. R30 Set containing thread cutting tools for all sizes from ¼" to 1" in both U. S. S. and S. A. E. threads, as well as sizes from No. 4 to No. 14 in Machine Screw Threads and ⅛ to ¼ Pipe Threads and the ⅞" Spark Plug Tap, is the most economical and efficient "Set" for the Automotive Repair Garage. It covers practically everything.

Adjustable Guide Die Stocks

	Price
Size 2. 14 in. long for 1½-in. outside diameter Dies...	$4.10
Size 3. 23 in. long for 2-in. outside diameter Dies.....	5.50

Special Garage Screw Plates


Keystone Round Die Screw Plate Set
KEYSTONE REAMER & TOOL CO.

Combination U. S. S. and S. A. E. Sizes

No. R-28. Sixteen Sizes: ¼-20, 5/16-18, ⅜-16, 7/16-14, ½-13, 9/16-12, ⅝-11, ¾-10, ¼-28, 5/16-24, ⅜-24, 7/16-20, ½-20, 9/16-18, ⅝-18, ¾-16, ⅞-18 Tap. ⅛, ¼ Pipe Taps.

Price $42.75. Weight 28 lbs.

No. R-29. Twenty Sizes: ¼-20, 5/16-18, ⅜-16, 7/16-14, ½-13, 9/16-12, ⅝-11, ¾-10, ⅞-9, 1-8, ¼-28, 5/16-24, ⅜-24, 7/16-20, ½-20, 9/16-18, ⅝-18, ¾-16, ⅞-14. 1-14, ⅞-18 Tap. ⅛, ¼ Pipe Taps.

Price $60.30. Weight 35 lbs.

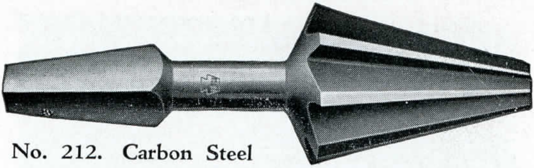
U. S. S. Machine Screw Sizes

No. R-6. Seven Sizes: 4-36, 6-32, 8-32, 10-24, 10-32, 12-24, 14-20.

Price $10.80. Weight 2 lbs.

These Screw Plate Sets include both Taps and Dies in the sizes mentioned and also the necessary Tap Wrenches, Die Stocks and Hexagon Die Holders.

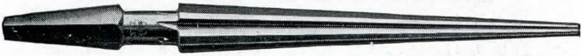
Short Burring Reamers



No. 212. Carbon Steel

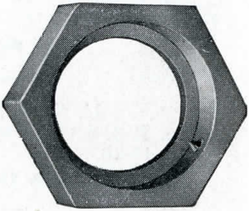
Size	Size at Small End Inch	Size at Large End Inches	Length of Flute Inches	Capacity	Each
0	3/16	3/4	1 1/8	1/8 in. to 1/2 in. Pipe	$1.10
1	7/32	1 1/2	2 1/4	1/4 in. to 1 1/4 in. Pipe	1.65
2	5/16	2 1/2	3 1/4	1/4 in. to 2 in. Pipe	3.25

Extra-Long Taper Reamers



Size	Length Over All Inches	Length Reamer Part Inches	Diam. at Large End Inch	Diam. at Point Inch	Wt. Oz.	Each	Doz.
1	6 1/2	4 1/2	1/2	1/8	2	$0.95	$11.40
2	6 1/2	4 1/2	1	3/8		1.95	23.40

Keystone Round Die Holder

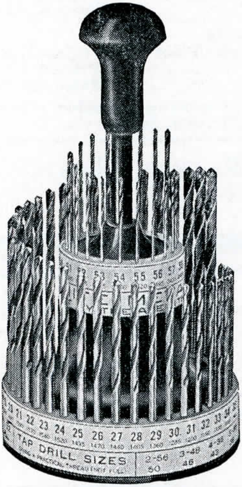


This specially designed Holder allows the round die to be used in connection with a monkey or socket wrench for threading or rethreading work where a regular die stock could not be used.

Size		Price
13/16	Holder for 13/16-inch outside diameter Dies	$0.85
1	Holder for 1-inch outside diameter Dies	1.05
1 1/2	Holder for 1 1/2-inch outside diameter Dies	1.70
2	Holder for 2-inch outside diameter Dies	2.75

Jobbers Drills

Diam. Inch	Price per Dozen		Diam. Inch	Price per Dozen	
	Carbon Steel No. 700	High Speed No. 700HS		Carbon Steel No. 700	High Speed No. 700HS
1/16	$1.15	$3.25	19/64	$2.90	$10.00
5/64	1.20	3.25	5/16	3.15	10.00
3/32	1.25	3.25	21/64	3.40	11.40
7/64	1.25	3.40	11/32	3.65	11.40
1/8	1.30	3.40	23/64	3.95	12.85
9/64	1.35	3.50	3/8	4.35	12.85
5/32	1.40	3.50	25/64	4.70	14.25
11/64	1.45	4.80	13/32	5.05	14.25
3/16	1.65	4.80	27/64	5.60	16.15
13/64	1.80	5.35	7/16	6.15	16.15
7/32	2.00	5.35	29/64	6.65	17.80
15/64	2.15	7.00	15/32	7.20	17.80
1/4	2.35	7.00	31/64	7.95	19.00
17/64	2.55	8.65	1/2	8.65	19.00
9/32	2.75	8.65			



TWIST DRILL SETS

WIRE GAUGE DRILLS

No. 80—Drills Nos. 1 to No. 60
With Stand complete...$10.35
Drills alone 7.80

JOBBERS DRILLS

No. 81—Drills 1/16 to 1/2 by 64ths
With Stand Complete...$11.50
Drills alone 9.00
(High Speed Quoted on Inquiry)

Other Drills

Letter Size Drills—No. A to Z
Wire Gauge Drills—No. 1 to 60.
S & Taper Shank Drills, 1/2 to 1"
Carbon and High Speed
Prices Upon Application

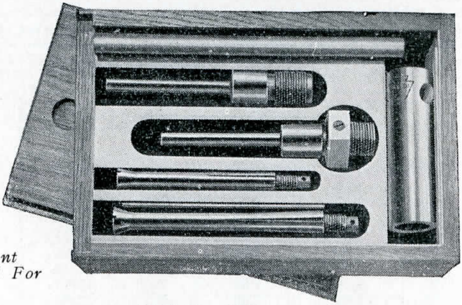
Battery Drills

For Use on Lead Terminals of Storage Batteries

1/2 inch	$1.75
5/8 inch	1.95
3/4 inch	2.10

Keystone Universal and Interchangeable Valve Stem Pilot and Guide Sets

Interchangeable with All Standard Cutters



Patent Applied For

SET No. 1335

Two Pilots and Two Guides—Valve-Stem Sizes 5/16 to 1/2
Shank and Handle............................Price $13.75
With Ford Model A Collet Guide...............Price $16.75

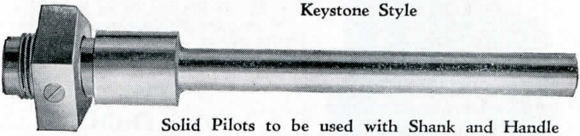
SET No. 1336

Two Pilots and Three Guides—Valve-Stem Sizes 5/16 to 11/16
Shank and Handle...........................Price $18.75
With Ford Model A Collet Guide..............Price $21.75

The Pilots will care for all and every conceivable valve-stem size within the limits given for each Set.

Solid Valve Seat Reamer Pilots

Keystone Style

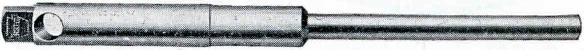


Solid Pilots to be used with Shank and Handle

5/16, 21/64, 11/32, 23/64, 3/8, 25/64, 13/32, 27/64, 7/16, 29/64, 15/32, 1/2, 9/16
and all Decimal Oversizes
Interchangeable with All Standard Cutters. Price $1.80 each

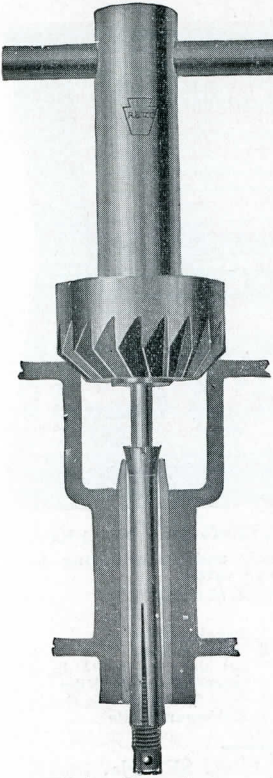
Solid Valve Seat Reamer Pilots

STANDARD STYLE



5/16, 21/64, 11/32, 23/64, 3/8, 25/64, 13/32, 27/64, 7/16, 29/64, 15/32, 1/2, 9/16
and all Decimal Oversizes
Interchangeable with All Standard Cutters. Price $1.75 each

Keystone Valve Reseating Tools



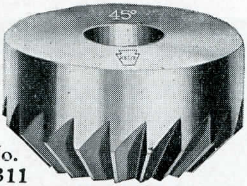
Valve Reseating Cutter

Complete with Shank. Pilot and Guide mounted in block ready for operation.

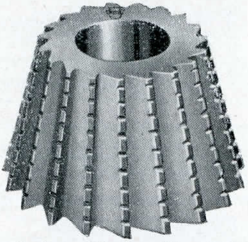
Pilot Set { 2 Pilots
2 Guides

Sizes 5⁄16 to ½ in.

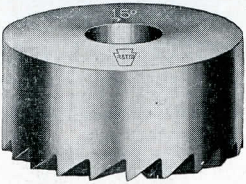
Price $13.75



No. 1311
45° Valve Seat Cutter



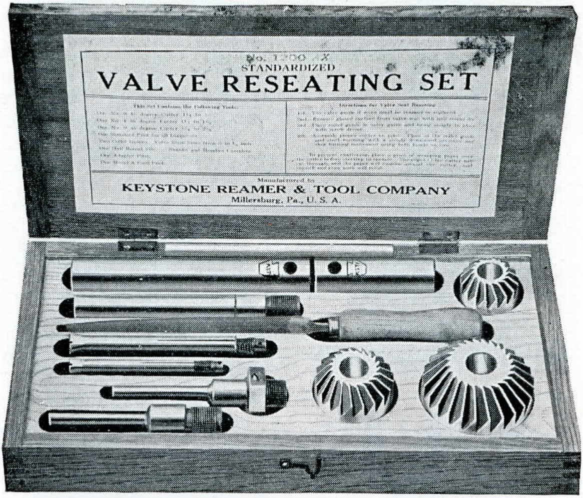
75° Port Cutter No. 1375



15° Port Cutter No. 1315

No.	Cutters For Valve Sizes	Valve No 1311	Port No 1315	Port No 1375	Price Each
x0	1¼ to 17⁄16	45°	15°	75°	$3.00
x1	1 ¼ to 1 ½	45°	15°	75°	$3.00
x2	1 5⁄16 to 1 9⁄16	45°	15°	75°	3.00
x3	1 ⅜ to 111⁄16	45°	15°	75°	3.00
x4	1 7⁄16 to 1 ⅞	45°	15°	75°	3.00
x5	1 ⅝ to 2	45°	15°	75°	3.00
x6	111⁄16 to 2 1⁄16	15°	15°	75°	3.25
x7	1 ⅞ to 2 ¼	45°	15°	75°	3.25
x8	1 ⅞ to 2 ½	45°	15°	75°	3.50
x9	1 ⅞ to 2 ⅝	45°	15°	75°	3.75
x30	1 ½ to 1 ¾	30°	15°	75°	3.00
x31	1 ¾ to 2 ¼	30°	15°	75°	3.25
x50	111⁄16 to 115⁄16	50°	15°	75°	3.00

Keystone Valve Reseating Reamer Sets



KEYSTONE VALVE RESEATING SET No. 1300X

This Set covers all passenger cars and trucks having detachable-head motors with 45-degree valves.

This set is interchangeable with all Standard makes.

3 Cutters No. 1311
For Valve Sizes
X0–1¼ to 1⁷⁄₁₆
X4–1⁷⁄₁₆ to 1⅞
X9–1⅞ to 2⅝
1 regular Shank complete
1 extra-long Shank complete

1 Regular Pilot
2 Collet Guides
All sizes ⁵⁄₁₆ to ½ in.
1 Interchangeable Pilot
1 Ford Model A Pilot Guide
1 Half-round File

Price $28.00

KEYSTONE VALVE RESEATING SET No. 1301X

This Set covers all passenger cars and trucks with detachable-head motors, having 45-degree valves. Also practically all cars having motors with 30-degree valves.

This set is interchangeable with all Standard makes.

7 No. 1311 Cutters—

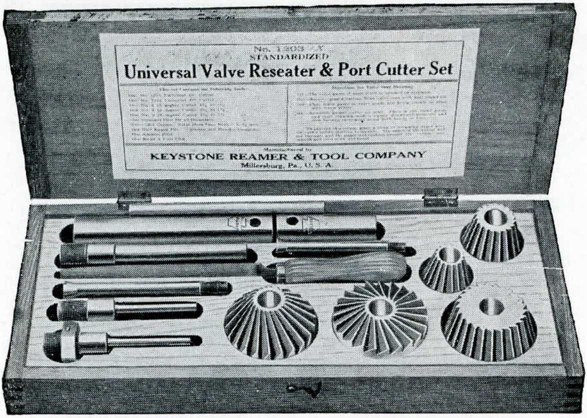
For Valve Sizes	Degrees
X0–1¼ to 1⁷⁄₁₆	45
X3–1⅜ to 1¹¹⁄₁₆	45
X4–1⁷⁄₁₆ to 1⅞	45
X5–1⅝ to 2	45
X7–1⅞ to 2¼	45
X9–1⅞ to 2⅝	45
X30–1½ to 1¾	30

1 regular Shank complete.
1 extra-long Shank complete.

1 Pilot
2 Collet Guides
All sizes—⁵⁄₁₆ to ½ in.
1 Interchangeable Pilot
1 Ford Model A Pilot Guide
1 Half-round File.

Price $38.00

Keystone Valve Reseating Reamer Sets


No. 1303 X
STANDARDIZED
Universal Valve Reseater & Port Cutter Set
KEYSTONE REAMER & TOOL COMPANY
Millersburg, Pa., U. S. A.

KEYSTONE VALVE RESEATING SET No. 1303X

This Set covers all passenger cars and trucks with detachable-head motors, having 45-degree valves. The Interchangeable Pilot in this Set makes it interchangeable with all Standard makes of Cutters. It contains the following:

Cutters	Valve Sizes	
1 Universal 45-degree	1¼ to 2⅝	1 Pilot
1 Universal 15-degree	1¼ to 2⅝	2 Collet Guides
1 X0—75-degree	1¼ to 1½	Sizes ⁵⁄₁₆ to ½ in.
1 X4—75-degree	1½ to 1⅞	1 Interchangeable Pilot
1 X9—75-degree	1⅞ to 2⅝	1 Ford Model A Pilot

One regular Shank, 1 extra-long Shank and Handle
One Half-round File

Price $38.00

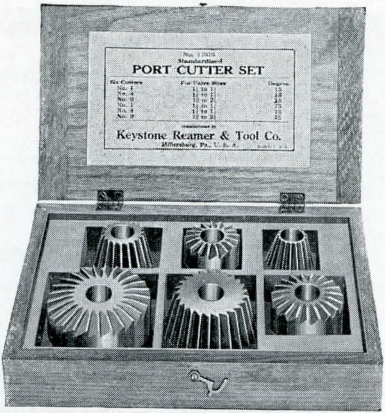
KEYSTONE VALVE RESEATING SET No. 1302X

For open-head motors with 45-degree valves. Covers 90 per cent of all passenger cars and many trucks containing 45-degree valves. It contains the following:

1 Universal Cutter—No. 1314
Size 1¼ to 2⅝
1 regular Shank and Handle complete
1 Pilot—2 Guides
Sizes ⁵⁄₁₆ to ½ in.
1 Interchangeable Pilot

Interchangeable with all Standard makes—Price $18.75

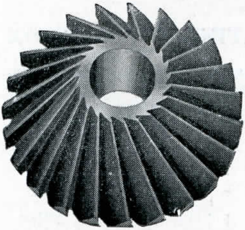
Keystone Port Reconditioning Set



This Set contains the following Cutters:

1X0—75° Cutter
Valve size
1¼ to 1 7/16
1X4—75° Cutter
Valve size
1 7/16 to 1⅞
1X9—75° Cutter
Valve size
1⅞ to 2⅝
1X0—15° Cutter
Valve size
1¼ to 1 7/16
1X4—15° Cutter
Valve size
1 7/16 to 1⅞
1X9—15° Cutter
Valve size
1⅞ to 2⅝

Price $19.50



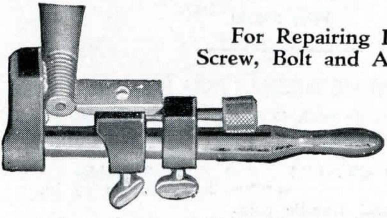
Universal Valve Seat Cutter for 45-Degree Valves

For 45 degree valves in open head motors
Size 1¼ to 2⅝

Price $4.50

Interchangeable with Standard Makes

Rethreader



For Repairing Damaged Screw, Bolt and Axle Threads

Range ¼″ to 2″
Threads 14, 16, 18, 24

Price $7.00

Extra Chasers and Other Threads. Price $1.00 each

"KEYSTONE TOOLS DO THE JOB RIGHT"

Keystone Piston Pin Hone

For Honing Piston Pin Bearings in Alignment

A simple, sturdy, mechanically built Hone having long stones that cover both bushings in actual operation. This Hone has no equal for simplicity, sturdiness, and fine operating results.

It will do just a little more than any other Hone and do it better.

It is a Real Tool
Covered by
Keystone's Unconditional Guarantee

The Hone is built in two sizes:

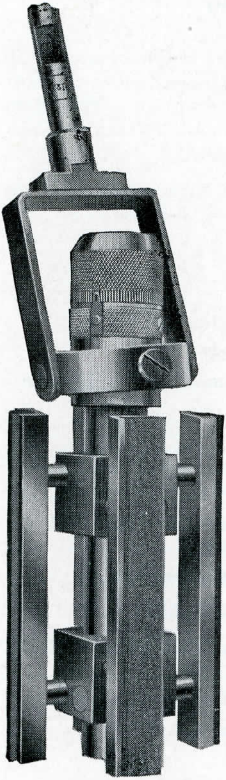
No. H01. Covering sizes from .734 to 1.125
Packed in Hardwood Case
Price $22.50

No. H02. Covering sizes from 1.125 to 1.9375
Packed in Hardwood Case
Price $25.00

Extra Stones for No. H01, $1.00 each

Extra Stones for No. H02, $1.50 each

Keystone
Cylinder Grinding Hone



A Rapid Cylinder Grinding Tool—Fast—Smooth—Accurate—No Springs—No Gears—Simple—Sturdy—Efficient—Fool-proof

A mechanically built tool of proper design. All parts carefully made and fitted.

For All Cylinders from $2\frac{11}{16}''$ to $4\frac{1}{4}''$ With One Set of Stones

EASY TO ADJUST

Upper Wheel for micrometer adjustment when operating.

Lower Knurled Nut for quick change adjustment.

Adjustment stays set.

Packed in Hardwood Case with Handle, Lock and Key

The Outfit Contains:

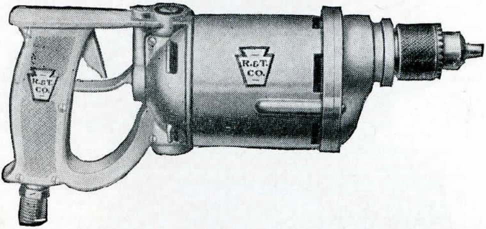
- The Hone Body complete.
- 2 Sets Stones (Roughing and Finishing).
- 1 Cleaning Brush.
- 1 Rubbing Stone.
- 1 Coarse File.
- 1 Stand Spring.
- 1 Set of Stand Foot Blocks.

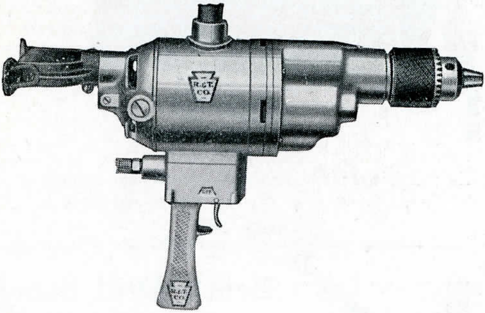
PRICE COMPLETE $51

Extra Stones

Per Set (2 Stones, 2 Neutrals), $4.00

Keystone Electric Drills





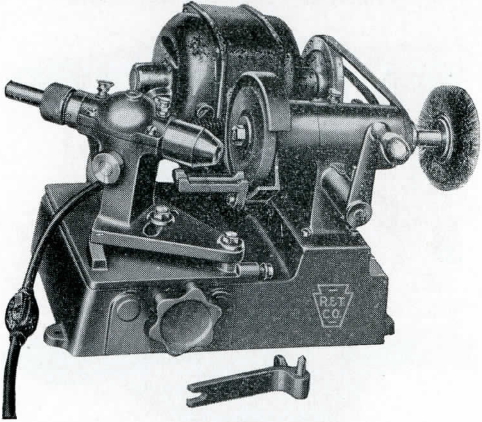
Aluminum Bodies. Ball Bearing Universal Motors.

Timken Thrusts. Chrome Nickel Gears.

PRICES

¼″ Special Electric Drill	$24.00
¼″ Regular Electric Drill	30.00
¼″ Heavy Duty Electric Drill	36.00
½″ Special Electric Drill	44.00
½″ Heavy Duty Electric Drill	63.00
⅝″ Heavy Duty Electric Drill	68.00
¾″ Heavy Duty Electric Drill	75.00

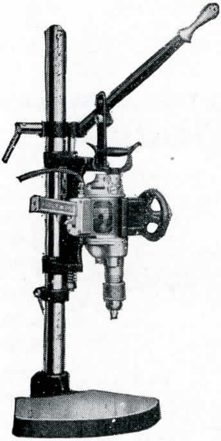
Keystone Valve Refacer



No. EDR 2

This machine is designed to grind all valves of 15° to 90° faces with 5/16″ to 1/2″ stem diameters.

Price $87



Bench Drill Stands

Type No. 1-B

Type No. 1-B Stands are for use with 1/2″ Special Drills.

No. ED22 Bench, Price $16
No. ED23, Post, Price $20

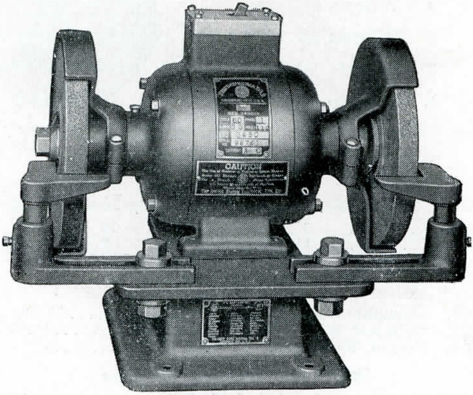
Type No. 1½

Type No. 1½ Stands are for use with 1/2″, 5/8″ and 3/4″ Heavy Duty Drills.

No. ED24 Bench, Price $28
No. ED25 Post, Price $32

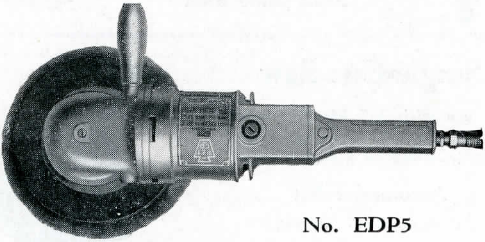
Keystone Bench Grinder

No. EDG1



Size, In.	H.P.	Speed	Wheel Size, Inches	Dimen., Inches	Price	
					A. C.	D. C.
6	¼	3450 R. P. M.	6 x ½ x ½	13 x 10	$34.50	$ 36.50
7	⅓	3450 R. P. M.	7 x ¾ x ½	13 x 10	56.00	58.00
8	½	3450 R. P. M.	8 x 1 x ⅝	17 x 12	98.00	102.00

Keystone Portable Electric Polisher

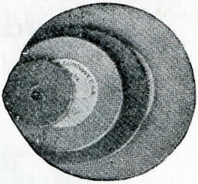


No. EDP5

For Cleaning and Polishing Automobile Bodies and Other Highly Polished Surfaces

Price $66

Abrasive Wheels



3″ Wheels 75 cts.
6″ Wheels $1.50
7″ Wheels $2.00
8″ Wheels $2.75

Keystone Wire Brushes

Wire Wheel Brushes, Wide, Heavy-Duty Brushes

Diameter ..	4 in.	6 in.	8 in.	10 in..	12 in.
Width	1 in.	1⅛ in.	1½ in.	2 in.	2½ in.
Price	**$2.50**	**$3.25**	**$3.50**	**$6.00**	**$8.00**

Wire Carbon-Cleaning Tools, Round

WB2-1.	Straight Wire	**75 cts. each**
WB2-2.	Crimped Wire	**$1.15 each**
WB2-3.	Flared Wire	**$1.75 each**

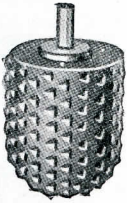
Wire Valve Guide Brushes

Sizes: 5⁄16″, 11⁄32″, ⅜″, 13⁄32″, 7⁄16″, ½″ .... **$1 each**

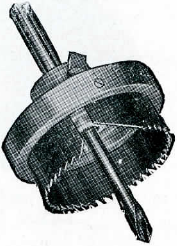
Round and Tapered Nose Rasps

Round and Tapered Nose Rasps are indispensable in tire-repair work.

Price $3.00 each



Single-Cut Saw



For use with ½″ Electric Drill. Cuts clean and finished round holes in wood or metal.

Automotive Set

Complete—17 Blades
Sizes: ¾″ to 3½″ x ¼ers

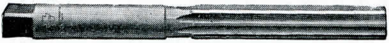
Price $20.00

INFORMATION SECTION
Valuable Data for Garage Mechanics

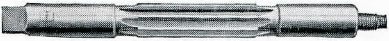
REAMERS

Types and Forms

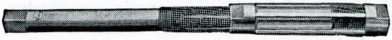
The automotive repair mechanic has to do principally with the Hand Reamer, which Reamer is made in three different types: Solid Hand Reamer, Expansion Hand Reamer and Adjustable Blade Hand Reamer.



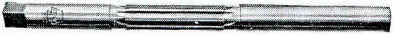
Solid



Expansion



Adjustable
Blade



Aligning

Each type is made with either straight or spiral flutes. The Aligning Reamer is a recent development of the regular Hand Reamer.

Purpose, Operation and Care

The purpose of a Hand Reamer is to finish a drilled hole so that it is *accurate, round and smooth.*

A Reamer is not a drill or rough-cutting tool, but a finishing tool, to give the last, fine, accurate finish to the job.

To successfully operate a Reamer requires considerable knowledge, skill and experience. An inexperienced or careless operator can easily ruin both tool and work.

About 95 per cent of all reaming troubles lie at the door of the operator and are not the fault of the tool.

All finish reaming should be done by hand—the best and most accurate results are obtained by hand work.

Reaming must be started right and steadily done.

It is not the easiest job to start a reamer true, it seems bound to start wrong and go crooked. Enter the reamer carefully in the hole, allowing the tapered end to center the tool; turn to right slowly, but firmly holding the reamer straight and true, feeding forward slowly and evenly as the work progresses.

A small amount of material should be removed at one cut, not over .005 to .008 of an inch. Two or three light cuts will produce much better work than one heavy cut.

When reaming is finished, the Reamer should be turned on through the work. If this cannot be done the Reamer should be drawn straight back while being turned to the right. *A Reamer should never be turned backward.*

A Reamer is a tool requiring the best of care. When not in use it should be washed in kerosene, wrapped in cloth, and laid carefully away in a tool-closet where it can be kept under lock and key.

Design and Finish

The Reamer is considered a very particular and fussy tool to build. In the factory all operations on the tool are considered important, each receiving careful inspection, but the operations receiving the closest attention and most rigid inspection are the two final important finishing ones. Namely:

1st. The Cylindrical Grinding. From which the Reamer gets its accurate size and true roundness.

2nd. The Relief Grinding. By which the blades of the Reamer are given their cutting properties.

1st. By Cylindrical Grinding is meant that the Reamer, after it is shaped, formed, hardened and tempered, etc., is ground throughout its whole length True and Round and to its exact Diameter Size and Fine Finish.

This is done by placing the Reamer between rotating centers on a Special Cylindrical Grinding machine and rotating the tool rapidly while passing it over the face of the grinding wheel running at very high speed.

This is a very particular and precision operation and requires skill and long experience on the part of the operator.

Cylindrical Grinding gives the Reamer its Roundness, Diameter Size and Fine Finish.

2nd. By Relief Grinding is meant that the backs of the blades of the Reamer are cut away, or as is commonly known backed off, to a pre-determined angle so that a Cutting Edge is produced on the blade and the blade given the necessary clearance for proper work.

This is done by placing the Reamer between fixed centers of a Special Reamer Grinding Machine, adjusting the tool, on a proper tooth-rest, so that its blades are slightly below the center of the grinding wheel, then passing the reamer fairly quickly over the face of the rapidly running grinding wheel, the reamer blade held solid against and sliding over the tooth-rest the full length of the blade.

The blade of a properly ground and relieved Reamer should have on its top, along its full length, immediately back of the cutting edge, a land about .002 of an inch in width. The purpose of this land is to give and maintain accuracy in the Size and Roundness of the Reamer and also to give needed Support to the cutting edge of the tool. This land is of extreme importance and must always be considered in the manufacture and reconditioning of Reamers. (This land will appear along the edge of the blade as a faint hair-line to the eye. This line is commonly known as the size line and is a proof that the Reamer's size and roundness are intact.)

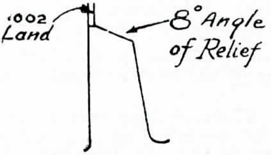
The relief angle is immediately back of the land, the blade being ground away to an angle of about 8 degrees.

If the angle of relief or clearance is too great, back of the proper width of land, the cutting edge of the tool will not have the necessary support and chattering will result.

If the angle of relief or clearance is too slight, back of the proper width of land, enough clearance would not be given to the backs of the blades, the Reamer would, therefore, drag and bind in the hole.

If in giving this angle of relief to the blade, the land is cut entirely away leaving only a sharp edge, the accurate Size and Roundness of the tool is lost and the cutting edge, having no support, will chatter, dig in, make trouble and rapidly wear away.

A cross-section of a properly ground and relieved Reamer blade would appear approximately as shown in illustration below.



To accurately grind and relieve a Reamer requires considerable skill and great care, and can only be successfully done by an expert who does this work exclusively and continually.

Reconditioning Reamers

Reamers, through rough use and abuse, principally abuse, become dull, their edges rounded and nicked, their fine finish spoiled.

Through careless or unskilled grinding or sharpening the Reamer is seriously damaged.

Such Tools can only be helped by expert reconditioning. This means that the Reamer must be put through exactly the same final grinding operations as were given it when it was first made, that is, it must first be again cylindrically ground, then again relief ground or backed off.

Simply trying to grind the Reamer blade along its old angle of relief or further backing it off will benefit the tool very slightly, and in the majority of cases entirely ruin it.

Recondition work on Reamers should be done at a factory making such tools or by an expert tool-grinder having the proper equipment for such work.

If such work is properly done the Tool will be practically new when finished.

Shop Conditioning and Care of Reamers

Under ordinary conditions the user of tools should keep them in condition. This is true of other fine tools and should be true of Reamers. The user should learn to keep his tools in condition.

If a Reamer is cared for as it should be, there is no reason that it should not last for a considerable period of time before being sent to the Factory for Regrinding and Reconditioning.

The main things that shorten and destroy the life of a Reamer are lack of care and carelessness of operators.

It is of course well known that even if the Reamer is given the best of superficial care and the operator is fairly proficient, it will after a time become dulled.

Yet it is also equally well known that any mechanic, worthy of the name, should be able to care for such troubles.

Practically 85 to 90 per cent of all real Reamer troubles can be remedied by the skillful use of the Reamer Hone Stone. It has been found, through practical experience, that the working abilities of all Reamers can be materially aided by the skillful use of the hone.

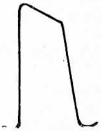
Of course this "Honing" must be skillfully and carefully done.

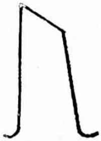
If the mechanic does not know how to use the Reamer Hone it certainly is time that he learns.

(This Reamer Hone Stone is the ordinary small-tool hone that can be obtained at almost any hardware store.)

Cut No. 1 below shows a cross-section of a Reamer blade that has become dull with rounded cutting edge.

Cut No. 2 below shows a cross-section of a Reamer blade having no land, it having been cut away by careless grinding. The edge is too keen.

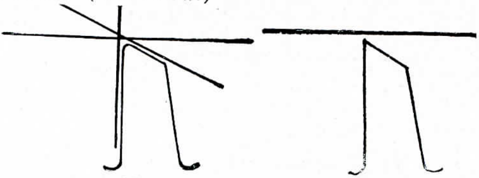

No. 1 Dull Round Edge


No. 2, Too Sharp, No Land

Both of these conditions are bad. However, if taken in time, either of them can be considerably helped by careful honing.

To correct condition No. 1: The hone should be used on the face of the blade, on the top of the blade, and on the angle of relief. (See below.)

To correct condition No. 2: The hone should be used on the top of the blade only and held square with its face. (See below.)


No. 1 No. 2

Care, experience, and skill are required in honing

Common Reaming Troubles

A few of the common reaming troubles are described as: (1) "Chattering." (2) "Digs in." (3) "Won't cut." (4) "Won't keep its edge." (5) "Not enough clearance." (6) "Not enough relief." "Soft."

1. "Chattering." Reamer vibration or chattering causing roughness and vertical marks on work is caused by
   (*a*) Unskilled handling of Reamer.
   (*b*) Reamer blades having too great relief.
   (*c*) Reamer having too sharp or too keen cutting blades. (As in illustration No. 2.)
2. "Digs in." A Reamer "digs in" and makes rough work because its cutting blades are too sharp, their edges are too keen. (As in illustration No. 2.)
3. "Won't cut."
   (*a*) Reamer is dull. (As in illustration No. 1.)
   (*b*) Forcing a Reamer through a hole already practically its diameter size. (A Reamer will cut only its size.)
   (*c*) Trying to take a very small cut out of a hole

having a burnt, glazed surface, such as a worn, glazed piston-pin bearing. (It is not practical to to take less than .005 of an inch material from a hole having a burnt, glazed surface. Don't try to fit less than a .005 oversize pin in an old, worn bearing.) (Remove glaze before reamiug.)

(*d*) Taking too large a cut. (Reamer chokes.)

4. "Won't keep its edge."

(*a*) A Reamer will become dull through constant use. Its edge will become rounded as in illustration No. 1, and it must be resharpened. (A Reamer should last a long while in ordinary work if it is properly handled and cared for. Reamers have frequently been known to cut over 5,000 holes.)

(*b*) A Reamer can be dulled almost immediately by trying to take a very small cut (.001 to .002) out of a hole having a burnt, glazed surface. (.005 of an inch cut at least should be taken from such a hole.) (Glaze should be removed before reaming by use of a glaze remover.)

(*c*) Allowing Reamers to lie around loose in contact with other Reamers or tools soon destroys their cutting edges. (Reamers should be kept wrapped in cloth and in a Reamer cabinet.)

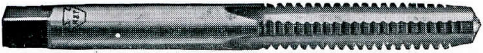
5. "Not enough clearance." Reamer drags and binds.
6. "Soft," and "Not enough relief."

These two troubles generally exist only in the mind of the operator.

Reliable tool manufacturers can be expected to send out tools that are made right.

However, if in doubt, don't guess: Try the top end of the blade with a file for *softness*. Mike the backs of the cutting blades (.005 under is plenty) for *relief*.

Screw Thread Cutting Taps and Dies



The function of Taps and Dies is to cut Screw Threads on the inside of holes and the outside of rods. (Styles and sizes of Screw Threads are shown on page 44.)

While the different operations needed and methods used and rules and designs followed in the manufacture of Screw Thread Cutting Taps and Dies are extremely intricate and important to obtaining Fine Tools, yet they are of very little practical value to the user of the tool.

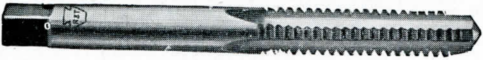
It therefore can be safely assumed that the reliable Tap and Die maker, producing "Standard" tools, furnishes Taps and Dies that closely meet all Standard Tests and requirements.

To get good results from the operating of both Taps and Dies in cutting Screw Threads, good tools are of course of the first necessity.

Also considerable skill and care must be exercised in the operation of such tools. Both Taps and Dies should be used by hand in Repair Garage work. Plenty of lubricant used at all times, Lard or Mineral Oil for ordinary work and Kerosine Oil for aluminum threading. Cast Iron can be threaded dry.

Taps or Dies should never be used on heat-treated or hardened steel parts if long life is expected of the tools. If properly treated both taps and dies will last many years.

Thread Cutting Taps



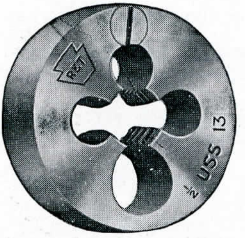
The function of a Thread-cutting Tap is to cut a Screw Thread on the inside of a prepared hole.

Holes for tapping should be drilled to the right size to give a 75 per cent depth of thread. (Proper Tap Drill Sizes are found on page 44.)

Care must be used to start the tap straight and square with the work. This is very important. A special standard Tap Wrench of the proper size should be used. The Tapered end of the Tap should be entered in the prepared hole. Advance the Tap slowly to the right as progress allows. Backing and advancing from time to time to allow Tap to clear until work is finished. Use plenty of oil.

Experience is needed to become proficient in tapping. If the Tap becomes dulled a slight grinding back of one or two threads of the tapered or chamfered point of the tap, along its original angles, is all that would be needed to put it in good shape again. Any mechanic should know how to do this.

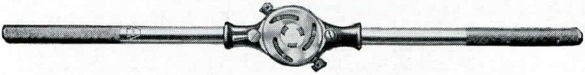
Thread Cutting Dies



The function of a Thread-cutting Die is to cut a Screw Thread on the outside of a prepared rod.

Rods to be threaded must be of the proper size. If the rod is too large it must be turned down. The end of the rod should always be beveled so that the die will go over the end and catch quickly and start evenly and easily. Care must be used to start the die true and square with the work. (This is very important.)

Adjustable Guide Die Stock

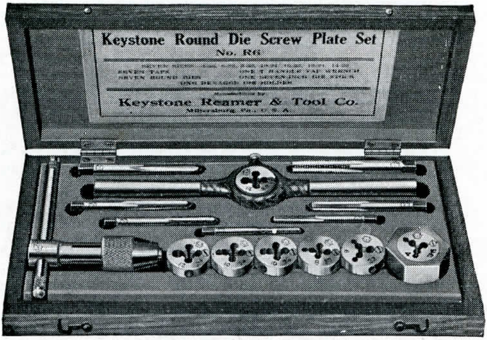


An adjustable guide die stock, of the proper size, should always be used to operate the die. (It will give trueness and steadiness to the work.)

The die should be placed in the die-stock and placed over the rod to be threaded. Proceed exactly as with the Tap until desired length of thread is obtained. (Using plenty of oil all the while.)

A die if carefully used and properly cared for should last for years. No sharpening should be necessary.

Screw Plate Sets

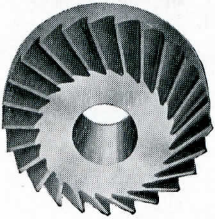

Keystone Round Die Screw Plate Set
No. R6
Keystone Reamer & Tool Co.

Screw Plate Sets are Combination Sets of Taps and Dies and the proper Die Stocks and Wrenches for same. They are generally selected for special purposes and are packed in hardwood cases for safety and convenience.

The Keystone Company prepares such Screw Plate Sets especially for Repair Garage Work, as well as for other purposes.

Taps and Dies and all other parts of Screw Plate Sets are valuable tools. They deserve good care. After use these tools should be cleaned, oiled and kept in their wood case, where they will be safe and at hand when next wanted.

Valve Reseating Reamers



The function or purpose of what is commonly known as the Valve Seat Reamer or Cutter is to produce, at its proper place, in the motor block a valve seat of the desired diameter, size and angle.

It is of course of the utmost importance to have correct Valve Seats.

Motor valves range in diameter sizes of from 1¼ inches to 4 inches, having face angles of 30°, 45°, 50°, and others, the 45° face angle being practically standard.

The Valve Seat Reamer or Cutter must, of course, be made in sizes and angles to cover the wide ranges of the valves themselves.

The Valve Seat Reamer is a very particular tool to manufacture. It must be extremely accurate, especially as to the angle of the face of its cutting blades and as to the relation of the cutting blades to its tapered center hole or arbor seat in which fits the tapered arbor head of the pilot stem. The Angle of the Cutting Blades must always be the exact specified taper angle and must be exactly square to and in alignment with the Tapered Center Hole. The cutting edges of the blades are ground to the desired angle and are cut sharp, they must be of the proper number and thickness and the relief or clearance must be exactly right.

From the above it is readily seen that great skill and care must be used in the manufacturing of the Valve Seat Reamer. From this must also be concluded that great skill and care should be used in the operation of this Tool. Rough usage and no care will soon ruin the Tool.

When the Tool is worn or damaged, owing to the many important points that must be taken into consideration, it is very difficult to properly recondition.

The cutting edge of the blades must always be ground to the proper taper angle square with the center hole, and with the proper clearance.

To do this the Cutter or Reamer must be mounted on an Arbor, having the exact tapered seat, as is in the Reamer itself, then placed between fixed centers in a Grinding Machine which can be arranged to give the proper degree of angle of blade (45° or other), and set upon a Tooth-rest which will give proper clearance, then each blade separately passed fairly rapidly over the face of a rapidly running grinding wheel.

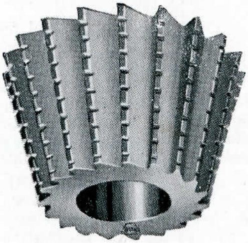
This is rather a ticklish operation and requires skill and experience and the proper equipment.

Not much help can be had with a tool-hone in reconditioning these reamer-cutters, as the angle of the blade is so easily changed, which destroys the precision of the tool.

With good judgment and care in the use of the tool it should last for quite a while before factory reconditioning or grinding is necessary.

The one main cause of Valve Seat Reamers becoming dulled or damaged, before their time, is the reaming of Seats that are covered with a burnt glazed surface. This should never be done. This glazed surface should be removed, with a rough file or a glaze breaker, before the Valve Seat Finishing Cutter is used.

Port Cutters

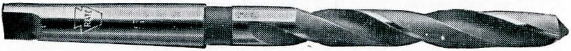


Port Cutters, which are used only to cut away metal from the top or sides of the ports after seats have become too wide from repeated reamings, are much easier reconditioned as here size of cutter or angle of degree or squareness or alignment is of little importance.

In operating a 75° Port Cutter very little downward pressure is needed. Too much pressure will cause this Tapered Reamer to "hog-in," become "clogged" and "stick-in-the-hole."

Honing of these tools is a great help, and grinding or reconditioning, when necessary, is easily done.

Twist Drills



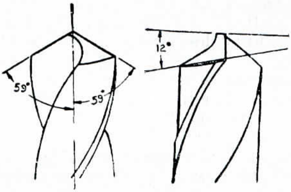
Twist Drills are used for making holes in metal and other hard surfaces.

The method of the manufacture of Twist Drills is of very little importance to the user. All of the well known Drill Manufacturers of today are producing an extremely reliable tool.

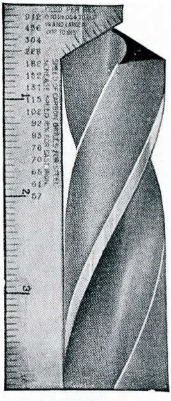
The methods of operation of Twist Drills are so widely known that very little need be said about same. Yet, even at that, it is pretty safe to say that when a Drill does not perform properly the chances are that the trouble lies with the operator's methods and not with the Drill.

A Drill, to operate correctly, must be *ground* properly and work at the proper speed.

The grinding of a Drill is rather ticklish, and should always be done to a Drill Gauge. (Such Gauges are not expensive.) Drills should never be ground to the eye alone.



Correct Point and Relief for Twist Drills



Drill Gauge

The Drill will always work best when properly sharpened. The two lips should be of equal length, and ground at an angle of 59 degrees. Each lip should be relieved on a straight angle back of the cutting edge to a clearance of about 12 degrees.

Drill Gauges are set to an angle of 59 degrees, to measure the point angle, and are graduated to measure the lengths of the cutting lips.

Twist Drills are made in both high speed and carbon steels. As the smaller sizes of Drills, up to ½-inch, are used in the repair garage in electric drill machines, they should be of high speed steel. Those over ½-inch, operating in a Drill press, need be carbon steel.

Given a reliable tool as is produced by any of the reputable manufacturers, and it is safe to say that practically all of the common drill troubles are the fault of the operator or the sharpening of the Tool, which amounts to the same thing.

Chipping of the Drill edge. Won't start. Drill splitting. Drill breaking. Hole too large, Etc., Etc., are all due to poor sharpening or bad operating.

Care for drills. See that they are properly ground and skillfully operated. Learn how to grind a drill, then do it as often as the drill shows even a slight dullness.

Pointers

On the Use of Reamers, Cutters, Taps, Dies and Drills

1—Buy only the "Best Tools." Keep them properly. Use them accurately.

2—When through using "Good Tools," clean, oil and lay carefully away in a Cabinet, Case or Rack.

3—When using a Reamer don't try to take a "Hog Bite." Small bites are better.

4—Don't force a Reamer into the work. Never turn it backwards. Learn to use it correctly and accurately.

5—Don't try to ream a burnt glazed Bushing or Valve Seat. It will ruin the tool. Remove the glaze first with a file or glaze-breaker, then do the reaming.

6—Don't use downward pressure on a heavily *tapered* Reamer or Port Cutter. The "Tool" will choke and stick. Turn lightly.

7—Keep your Reamer in good "Cutting Condition" by frequent dressing with a hone-stone. It is wonderful what an accurate hone-dressing will do for a reamer.

Learn to hone your Reamer accurately and do it frequently.

8—Store and handle your Reamers properly. Dress them frequently with a Reamer Hone. Keep them clean and in good condition and they will last you for years. If a Reamer is hone-dressed frequently, regularly and accurately, grinding may never be necessary.

9—When Cutting Screw Threads don't use a Tap in a hole that is too small or a Die over a rod that is too large. See that the hole or the rod is the correct size. Beveling the top of the rod helps the Die to start easily and true.

10—Use plenty of Oil when cutting screw threads. Don't push the Tap or Die too hard. Take a little bite, then back and clear, then take another bite. Saves the Tool and produces better work.

11—In using a Twist Drill see that it is sharpened properly. To operate right it must be sharpened to a gauge. 95% of all Drill troubles are due to poor sharpening.

12—Don't operate a Carbon Drill at High Speed. Use High Speed Drills.

Investigate Tool Troubles

As already stated, it has been found that 95 per cent of all tool troubles lie with the operator and are not the fault of the tool. When trouble arises, it is not fair to jump at conclusions and blame the tool. Make an investigation, find the trouble, and remedy it. A real mechanic would do this.

Facts on Motor Reconditioning to Remember

Cylinder Reconditioning

The Cylinder Walls of an Automobile Motor must be Straight, True, Round, Smooth and in exact alignment or Square with the machined top or bottom of the block.

The Piston will then fit correctly and operate smoothly and efficiently in alignment connection with the Crankshaft.

If these conditions, or any of them, are not present, the Motor will not operate correctly.

Piston Fitting

Pistons are ground to fit the cylinder upon a proper grinding machine, mounted between correctly provided centers.

To correctly fit the Cylinder, the Piston must be Round, True, Straight and Smooth, and have the proper clearance recommended by the manufacturer.

Piston Pin Fitting

In fitting Piston Pins, the important things to be remembered are:

That the Piston Pin Bearings must be reamed Round, Smooth and True.

The Bearings must be in exact alignment with each other and Square with the Skirt of the Piston.

The Pin, when correctly fitted, should have the greatest possible Surface Contact with the Bearings, and be Square with the Cylinder Walls and in parallel alignment with the Crankshaft.

These conditions give the greatest operating efficiency.

Valve Refitting

A proper and perfectly fitted Motor Valve is one having the greatest possible surface contact between its face and its seat and be so mounted in its guide that it will be guided, during operation, Straight and True so that it will continually and consistently Seat properly.

To obtain this condition:

First. The Valve Guide must first be True.

Second. The Valve Seat reamed in alignment with the Valve Guide.

Third. The Valve, with a Correct Stem and True Face, ground or lapped into place.

Connecting Rod Refitting

In Connecting Rod Bearing Refitting the important things are:

That the bearings at the top and bottom of the Rod must be in exact parallel alignment with each other.

That the bearings are Smooth and True and give the greatest possible Surface Contact with the Pin and Shaft operating in same.

Crankshaft and Camshaft Refitting

In refitting the bearings of the Crankshaft and Camshaft the important things to remember are:

That the bearings are Round, Smooth and True and are properly fitted to the shaft with the proper allowance for clearance.

That the Bearings and the Shaft at all places have the greatest possible surface contact.

That the Bearings are in exact alignment with each other.

That the Crankshaft Bearings be in the exact center of the Cylinders.

That the Camshaft Bearings be parallel with the Crankshaft Bearings and at the proper distance from them so that the timing gears operate properly.

When the Crankshaft has been properly placed and fitted and the Camshaft, Cylinder Walls, Piston Skirts, Piston Pins and Connecting Rod Bearings are in perfect alignment with the same and with each other, then and then only will the motor operate smoothly and efficiently in so far as these parts are concerned.

In other words, all these moving parts must be in exact alignment with each other to have the motor operate properly.

Hints on Other Automotive Work

In King Bolt fitting the bearings must be kept in exact alignment with each other—True, Round and Smooth. They must be kept in approximately their original position, given by the Car Manufacturer, so that the original alignment of the Wheels be maintained.

Whenever a moving Shaft is carried by two or more bearings, all of these bearings must be placed in exact alignment with each other. Otherwise such Shafts will not operate efficiently.

Whenever a Shaft or Pin is fitted in a bearing, one of the important results to be strived for is to obtain the greatest possible surface contact between the Shaft and Bearing. In other words, the surface of the shaft should come in contact with the surface of the bearing, throughout its whole area, or as near 100 per cent as possible. Not only in Spots.

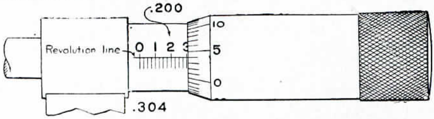
When reconditioning a Cylinder Block it is the safest to remove the "Block" from the frame. The work can be done easier, more accurately and more thoroughly. The Block and Cylinders will be completely inspected and more carefully and thoroughly cleaned. No Cuttings, Dust or Dirt to bother with. In Cylinder work the Cylinder Walls must not only be Round, Straight and True, but these Walls must be Square with the machined top and bottom of the "Block," and therefore in alignment with the Crankshaft. Such work can only be done by first Reboring and then Honing.

TO OPERATE AND READ THE MICROMETER

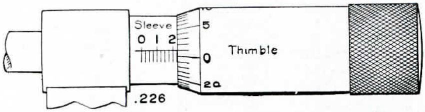
To operate the Micrometer turn the Thimble backwards until the piece to be measured can be easily placed between the measuring points; now turn the Thimble the opposite way until the measuring points bear lightly on the piece between them. The measurement is now shown by the lines and figures on the Sleeve and Thimble and is taken as follows:

Beginning at the largest figure showing over the Revolution Line and calling it hundreds of thousandths (if the figure is 2, call it .200 (200/1000, etc.), add to this .025 (25/1000) for each vertical line showing on the Sleeve between the figure taken and the edge of the Thimble, and to this also add .001 (1/1000) for each line showing on the Thimble between the 0 and the Revolution Line after 0 has passed below the Revolution Line. This will be the correct measurement.

No. 1



No. 2



The illustration above shows the method of reading the Micrometer very clearly.

The illustration marked No. 1 shows the Micrometer standing at .304 (304/1000). The largest figure showing over the Revolution Line is 3; this is .300 (300/1000), and there are no vertical lines showing on the Sleeve between the 3 and the edge of the Thimble, so the reading is still .300; however, it is seen that the 0 line on the Thimble has passed below the Revolution Line so that four lines show on the Thimble between the 0 line and the Revolution Line, which means that .004 (4/1000) must be added to the .300, which makes the reading .304. (.300 + .004 = .304.)

The illustration marked No. 2 shows the Micrometer standing at .226. The largest figure showing over the Revolution Line is 2 or .200; also one vertical line shows on the Sleeve between the 2 and the edge of the Thimble; this equals .025 which added to the .200 equals .225; but the 0 line on the Thimble has passed below the Revolution Line and one line shows on the Thimble, and as this equals .001 this also must be added to the reading, which now equals .226. (.200 + .025 + .001 = .226.)

Tap Drill and Thread Sizes

The Tap Drills recommended here will give approximately 75 per cent of a full thread.

75 per cent Thread is recommended for all shop practice.

Tap Drill Sizes for U. S. Standard Threads

Size of Tap Inches	per Threads Inch	Drill Sizes 75 % Thread Inch	Size of Tap Inches	Threads per Inch	Drill Sizes 75 % Thread Inches
1/4	20	7	7/8	9	49/64
5/16	18	17/64	15/16	9	53/64
3/8	16	5/16	1	8	7/8
7/16	14	3/8	1 1/16	8	15/16
1/2	13	27/64	1 1/8	7	63/64
9/16	12	31/64	1 3/16	7	1 3/64
5/8	11	17/32	1 1/4	7	1 7/64
11/16	11	19/32	1 5/16	7	1 11/64
3/4	10	21/32	1 3/8	6	1 7/32
13/16	10	23/32	1 1/2	6	1 11/32

For A. S. M. E. Machine Screws

Size of Tap and Threads per Inch	Size of Drill for Tap Hole 75% Thread	Size of Tap and Threads per Inch	Size of Drill for Tap Hole 75% Thread
0 x 80	3/64	8 x 32	29
1 x 72	53	9 x 32	26
2 x 56	50	10 x 32	21
3 x 48	47	10 x 24	25
4 x 36	44	12 x 24	16
5 x 36	40	14 x 24	7
6 x 32	36	14 x 20	10
7 x 32	31	16 x 20	7/32

For S. A. E. Standard Threads

Size of Tap Inch	Threads per Inch	Drill Sizes 75% Thread Inch	Size of Tap Inches	Threads per Inch	Drill Sizes 75% Thread Inches
1/4	28	3	3/4	16	11/16
5/16	24	17/64	7/8	14	13/16
3/8	24	21/64	1	14	15/16
7/16	20	25/64	1 1/8	12	1 3/64
1/2	20	29/64	1 1/4	12	1 11/64
9/16	18	33/64	1 3/8	12	1 19/64
5/8	18	37/64	1 1/2	12	1 27/64
11/16	16	5/8			

For Briggs' Standard Pipe Threads

1/8–11/32	3/8–37/64	1–15/32	1 1/4–1 1/2
1/4–7/16	3/4–59/64	1/2–23/32	1 1/2–1 47/64

Table of Decimal Equivalents

Of 8ths, 16ths, 32ds and 64ths of an inch

8ths
1/8 = .125
1/4 = .250
3/8 = .375
1/2 = .500
5/8 = .625
3/4 = .750
7/8 = .875

16ths
1/16 = .0625
3/16 = .1875
5/16 = .3125
7/16 = .4375
9/16 = .5625
11/16 = .6875
13/16 = .8125
15/16 = .9375

32ds
1/32 = .03125
3/32 = .09375
5/32 = .15625
7/32 = .21875
9/32 = .28125
11/32 = .34375
13/32 = .40625
15/32 = .46875
17/32 = .53125
19/32 = .59375
21/32 = .65625
23/32 = .71875
25/32 = .78125
27/32 = .84375
29/32 = .90625
31/32 = .96875

64ths
1/64 = .015625
3/64 = .046875
5/64 = .078125
7/64 = .109375
9/64 = .140625
11/64 = .171875
13/64 = .203125
15/64 = .234375
17/64 = .265625
19/64 = .296875
21/64 = .328125
23/64 = .359375
25/64 = .390625
27/64 = .421875
29/64 = .453125
31/64 = .484375
33/64 = .515625
35/64 = .546875
37/64 = .578125
39/64 = .609375
41/64 = .640625
43/64 = .671875
45/64 = .703125
47/64 = .734375
49/64 = .765625
51/64 = .796875
53/64 = .828125
55/64 = .859375
57/64 = .890625
59/64 = .921875
61/64 = .953125
63/64 = .984375

The Speed of Carbon Steel Drills

Experience in the use of Twist Drills, in boring holes of various sizes in different kinds of metals, has proved the following table to be practically correct, and the life of the Drills when run at these speeds is greater, if the metal to be drilled is in proper working condition, than if they were run at a greater number of revolutions per minute.

High Speed Drills should operate at two to three times the speed of Carbon Steel Drills.

The feed should be the same per revolution as the Carbon Steel Drills.

Diam. of Drills	Speeds on Steel	Speeds on Iron	Speeds on Brass	Diam. of Drills	Speeds on Steel	Speeds on Iron	Speeds on Brass
1/16	1650	2320	3475	13/16	121	162	242
1/8	839	1159	1737	7/8	114	150	217
3/16	562	761	1150	15/16	107	137	198
1/4	380	536	840	1	100	125	178
5/16	309	435	671	1 1/16	95	120	169
3/8	258	361	555	1 1/8	91	115	160
7/16	219	305	475	1 3/16	87	110	152
1/2	178	240	397	1 1/4	83	105	142
9/16	157	218	355	1 5/16	79	100	135
5/8	142	200	318	1 3/8	75	95	127
11/16	135	188	288	1 7/16	70	90	121
3/4	128	175	254	1 1/2	65	85	117

Useful Information

In using a Hack Saw, put the Saw in the frame as tightly as possible, bear down on the forward stroke, and ease up on the return stroke. Do not bend sidewise.

To harden Carbon Tool Steel, heat to a bright cherry red and cool quickly in water. To draw the temper, clean a small place with file, heat on iron plate over fire until cleaned place shows a light straw color, take from fire and cool in water.

To tell the difference between Carbon and High Speed Tool Steel, hold samples against an emery wheel: the Carbon Steel gives off large quantities of bright yellow sparks; High Speed Steel gives off very small amounts of dark red sparks.

In replacing bushings do not use a hammer—use a press.

A hammer made of lead is a mighty handy Repair Garage tool.

Feet .... × .00019 = miles.
Yards .... × .0006 = miles.
Links .... × .22 = yards.
Links .... × .66 = feet.
Feet .... × 1.5 = links.
Square inches .... × .007 = square feet.
Square feet .... × .111 = square yards.
Acres .... × 4840 = square yards.
Square yards .... × .0002066 = acres.
Width in chains........... × 8 = acres per mile run.
Cubic feet .... × .04 = cubic yards.
Cubic inches .... × .00058 = cubic feet.
Bushels .... × .0476 = cubic yards.
Bushels .... × 1.284 = cubic feet.
Bushels .... × 2218.2 = cubic inches.
Cubic Feet .... × .779 = bushels.
Cubic inches .... × .00045 = bushels.
Gallons .... × .1605 = cubic feet.
Gallons .... × 277.2 = cubic inches.
Cubic feet .... × 6.232 = gallons.
Cubic inches .... × .003607 = gallons.
Lbs. .... × .009 = cwts.
Lbs. .... × .00045 = tons.

LUBRICANTS FOR CUTTING TOOLS

Soda Water for Turning and Milling.
Soda Water for Grinding.
Lard Oil for Tapping.
Kerosine and Engine Oil for Honing.
Kerosine for Aluminum Working.

RULES FOR DETERMINING SIZE AND SPEED OF PULLEYS

The driving pulley is called the Driver and the driven pulley the driven. If figuring for gears, substitute number of teeth for diameter.

$$\text{The Diameter of the Driver} = \frac{\text{Diam. of Driven} \times \text{Revolutions of Driven}}{\text{Revolutions of Driver}}$$

$$\text{The Diameter of the Driven} = \frac{\text{Diam. of Driver} \times \text{Revolutions of Driver}}{\text{Revolutions of Driven}}$$

$$\text{Revolutions of the Driver} = \frac{\text{Diam. of Driven} \times \text{Revolutions of Driven}}{\text{Diameter of Driver}}$$

$$\text{Revolutions of the Driven} = \frac{\text{Diam. of Driver} \times \text{Revolutions of Driver}}{\text{Diameter of Driven}}$$

ACIDS FOR SOLDERING OR WELDING

Iron or Steel: Borax or Sal-ammoniac.
Tinned Iron: Resin or Chloride of Zinc.
Copper or Brass: Sal-ammoniac or Chloride of Zinc.
Zinc: Chloride of Zinc (pieces of Zinc in Muriatic Acid).
Lead: Tallow or Resin.
Lead and Tin Pipes: Resin and Sweet Oil.

USEFUL INFORMATION

To find the circumference of a circle, multiply the diameter by 3.1416.

To find the diameter of a circle, multiply the circumference by .31831.

To find the area of a circle, multiply the square of the diameter by .7854.

To find the surface of a ball (sphere), multiply the square of the diameter by 3.1416.

To find the side of an equal square, multiply the diameter by .8862.

To find the cubic inches (volume) in a ball, multiply the cube of the diameter by .5236.

Doubling the diameter of a pipe increases its capacity four times.

The radius of a circle × 6.283185 = the circumference.

The square of the diameter of a circle × .7854 = the area.

The square of the circumference of a circle × .07958 = the area.

Half the circumference of a circle × half its diameter = the area.

The circumference of a circle × .159155 = the radius.

The square root of the area of a circle × .56419 = the radius.

The square root of the area of a circle × 1.12838 = the diameter.

A gallon of water (U. S. Standard) weighs 8½ pounds and contains 231 cubic inches. A cubic foot of water contains 7½ gallons, 1728 cubic inches, and weighs 62½ pounds.

To find the pressure in pounds per square inch of a column of water, multiply the height of the column in feet by .434.

Steam rising from water at its boiling point (212 degrees

F.) has a pressure equal to that of the atmosphere at sea-level (14.7 pounds per square inch).

To evaporate one cubic foot of water requires the consumption of 7½ pounds of ordinary coal, or about 1 pound of coal to 1 gallon of water.

Each nominal horse-power of a boiler requires 30 to 35 pounds of water per hour.

One cubic foot of anthracite coal weighs about 53 pounds.

One cubic foot of bituminous coal weighs from 47 to 50 pounds.

One ton of coal is equivalent to two cords of wood for steam purposes.

There are 9 square feet of heating surface to each square foot of grate surface.

The average consumption of coal for steam boilers is 12 pounds per hour for each square foot of grate surface.

No plate or bars of either steel or iron should be worked at a **black or blue heat** (say about 500°); the material will stand far more strain **either red hot or cold,** while at an intermediate point great risks will be run, and possibly strains produced which result in rupture later on.

1 degree Fahrenheit = .5556 degrees Centigrade.
1 degree Centigrade = 1.8 degrees Fahrenheit.
1 horse-power = 33,000 foot pounds per minute.
1 horse-power = 746 watts.
1 watt = .0013 horse-power.
1 kilowatt = 1,000 watts.
1 kilowatt = 1.34 horse-power.
1 B. T. U. = .00039 horse-power.

WEIGHTS AND MEASURES

TROY WEIGHT.—24 grains = 1 pwt.; 20 pwts. = 1 ounce; 12 ounces = 1 pound. Used for weighing gold, silver, and jewels.

APOTHECARIES' WEIGHT.—20 grains = 1 scruple; 3 scruples = 1 dram; 8 drams = 1 ounce; 12 ounces = 1 pound. The ounce and pound in this are the same as in Troy Weight.

AVOIRDUPOIS WEIGHT.—$27\frac{11}{32}$ grains = 1 dram; 16 drams = 1 ounce; 16 ounces = 1 pound; 100 pounds = 1 cwt.; 2,000 pounds = 1 short ton; 2,240 pounds = 1 long ton.

1 oz. Troy = 480 gr., 1 oz.; Av. = 437½ gr.; 1 lb. Troy = 5,760 gr.; 1 lb. Av. = 7,000 gr.

DRY MEASURE.—2 pints = 1 quart; 8 quarts = 1 peck; 4 pecks = 1 bushel.

LIQUID MEASURE.—4 gills = 1 pint; 2 pints = 1 quart; 4 quarts = 1 gallon; 31½ gallons = 1 barrel; 2 barrels = 1 hogshead. Barrels and hogsheads vary in size.

TIME MEASURE.—60 seconds = 1 minute; 60 minutes = 1 hour; 24 hours = 1 day; 7 days = 1 week; 28, 29, 30 or 31 days = 1 calendar month (30 days = 1 month in computing interest); 365 days = 1 year; 366 days = 1 leap year.

CIRCULAR MEASURE.—60 seconds = 1 minute; 60 minutes = 1 degree; 30 degrees = 1 sign; 90 degrees = 1 quadrant; 4 quadrants = 12 signs, or 360 degrees = 1 circle.

LONG MEASURE.—12 inches = 1 foot; 3 feet = 1 yard; 5½ yards = 1 rod; 40 rods = 1 furlong; 8 furlongs = 1 stat. mile; 3 miles = 1 league.

MARINER'S MEASURE.—6 feet = 1 fathom; 120 fathoms = 1 cable length; 7½ cable lengths = 1 mile; 5,280 feet = 1 stat. mile; 6,085 feet = 1 naut. mile.

MISCELLANEOUS.—4 inches = 1 hand; 18 inches = 1 cubit; 21.8 inches = 1 Bible cubit; 2½ feet = 1 military pace.

SQUARE MEASURE.—144 sq. inches = 1 sq. foot; 9 sq. feet = 1 sq. yard; 30¼ sq. yards = 1 sq. rod; 40 sq. rods = 1 rood; 4 roods = 1 acre; 640 acres = 1 sq. mile.

SURVEYORS' MEASURE.—7.92 inches = 1 link; 25 links = 1 rod; 4 rods = 1 chain; 10 sq. chains or 160 sq. rods = 1 acre; 640 acres = 1 sq. mile or section; 36 sq. miles (6 miles square) = 1 township.

CUBIC MEASURE.—1,728 cubic inches = 1 cubic foot; 27 cubic feet = 1 cubic yard; 2,150.42 cubic inches = 1 standard bushel; 231 cubic inches = 1 standard gallon; 1 cubic foot = about four-fifths of a bushel; 128 cubic feet = 1 cord (wood); 40 cubic feet = 1 ton (shipping).

MISCELLANEOUS TABLES

12 units = 1 dozen
12 dozen = 1 gross
12 gross = 1 great gross

PAPER

24 sheets = 1 quire
20 quires = 1 ream

APPROXIMATE METRIC VALUES

1 decimeter = 4 inches
1 meter = 39 inches
5 meters = 1 rod
1 kilometer = ⅝ mile
1 square meter = 10¾ sq. ft.
1 hectare = 2½ acres

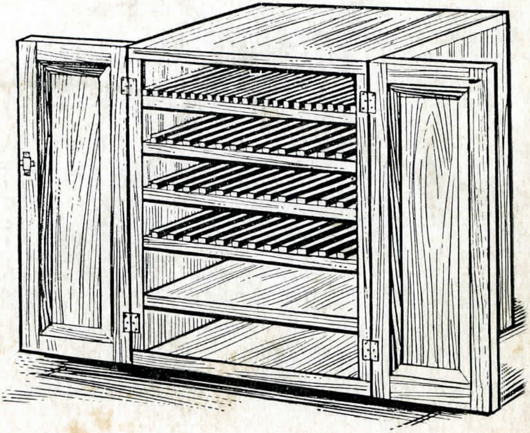
1 cu. meter = 1⅓ cu. yd. or ¼ cord
1 liter = 1 quart
1 hectoliter = 2½ bushels
1 gram = 15½ grains
1 kilogram = 2¼ pounds
1 ton = 2,200 pounds

TO FIND THE RATED HORSE-POWER OF GAS MOTORS

Square the diameter of the cylinder bore and multiply this by 4/10.

Thus a 4-cylinder motor with 3-inch diam. cylinder.
Square 3-inch diam. bore = 3 × 3 = 9 inches.
Multiply by 4 cylinders = 9 × 4 = 36.
Multiply by 4/10 = 36 × 4/10 = 14.4 H.P.

TOOL CABINET



KEEP YOUR TOOLS IN A CABINET

This Tool Cabinet can be easily and cheaply built; ¾-inch lumber is used throughout for cabinet and shelves. The small divisions are of ¼-inch square strips. The outside measurements are 18¾ inches wide, 25¼ inches high and 15½ inches deep.

It should have a lock and key.

In the new Keystone Catalog is shown a complete line of Automotive Reamers, Taps, Dies, Screw Plates, Drills, Valve Tools, Hones, Electric Drills, Electric Grinders, Etc., Etc., Etc.

It is free, sent out upon request. Write for it today.

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Millersburg, Penna., U. S. A.

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